



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appellant: MOHAMMED AZAM HUSSAIN

Examiner: Fortuna, Ana M.

Serial No.: 10/605,974

Group Art Unit: 1723

Filed: November 11, 2003

For: PROCESS FOR PRE-TREATING
AND DESALINATING SEA WATER

Commissioner for Patents
Alexandria, VA 22313-1450

BRIEF OF APPELLANT

Sir:

This is an appeal from the Final Rejection of the Examiner dated February 21, 2006, rejecting Claims 1 to 11 and 14 to 22.

(i) Real Party In Interest

The real party in interest is the inventor, Mohammed Azam Hussain.

(ii) Related Appeals and Interferences

There are no related appeals or interferences.

(iii) Status of Claims

Claims 1 to 20 were filed with the application.

Claims 12 and 13 were canceled.

Claims 21 and 22 were added by amendment.

Claims 1 to 11 and 14 to 22 were rejected.

Claims 1 to 11 and 14 to 22 are appealed.

(iv) Status of Amendments

An amendment was submitted after the Final Rejection but was not entered.

(v) Summary of claimed subject matter

Claims 1, 15, and 18 are independent claims and Claims 6, 21, and 22 are separately argued.

Claim 1

Referring to Figure 1, Claim 1 is for a process for treating sea water.

(A) To the sea water (paragraph [0012], lines 11 to 22; A in Fig. 1) is added about 0.1 to about 60 g/L sodium hydroxide, sodium carbonate, potassium hydroxide, potassium carbonate, calcium hydroxide, calcium carbonate, aluminum hydroxide, aluminum sulfate, aluminum potassium sulfate, or a mixture thereof (paragraph [0013], lines 2 to 5; B in Fig. 1). A precipitate of a calcium compound (paragraph [0014], lines 1 to 5; D in Fig. 1) forms in the water (paragraph [0015]; C in Fig. 1).

(B) The precipitate is separated from the water (paragraph [0014], lines 5 to 6).

(C) The water is desalinated (paragraph [0021], lines 1 to 5; E, F, or G in Fig. 1).

Claim 6

Claim 6 depends from Claim 1, but in addition requires the desalination to produce a first stream that has a lower concentration of dissolved solids and a second stream that has a higher concentration of dissolved solids (paragraph [0023], lines 1 to 7). A mixture is formed (top block in Fig. 2) of the second stream (paragraph [0023], lines 7 to 10; E2 in Fig. 1) and the sea water (A in Fig. 1). If the concentration of the compound added in step (A) of Claim 1 is less than about 0.1 wt%, then a sufficient amount of the compound is added to the mixture to bring its concentration within a range of about 0.1 to about 60 wt% (paragraph [0023], lines 12 to 15). The mixture is then recycled to step (B) of Claim 1 (paragraph [0023], 4 to 5; B in Fig. 1).

Claim 15

Referring to Figure 1, Claim 15 is for a process for treating sea water to reduce the concentration of dissolved salts in it. Claim 15 is similar to Claim 1 except that instead of both the calcium compounds and the sodium compounds being added in step (A), the calcium compounds are added first, giving a first precipitate, and the sodium compounds are added second, giving a second precipitate (paragraph [0016], lines 1 to 3).

(A) To the sea water (A in Fig. 1) is added about 0.04 to about 40 g/L calcium hydroxide, calcium oxide, or a mixture thereof (paragraph [0016], lines 3 to 8; B in Fig. 1). A first precipitate forms (D in Fig. 1) that comprises calcium

hydroxide (paragraph [0016], lines 9 to 10).

(B) The first precipitate (D in Fig. 1) is separated from the water (paragraph [0016], lines 11 to 12; C in Fig. 1).

(C) To the water (also A in Fig. 1) is added about 0.01 to about 60 g/L sodium carbonate and about 0.04 to about 40 g/L sodium hydroxide (paragraph [0017], lines 1 to 2; also B in Fig. 1). A second precipitate forms that comprises magnesium hydroxide (paragraph [0017], lines 8 to 10; also in D in Fig. 1).

(D) The second precipitate (also D in Fig. 1) is separated from the water (paragraph [0017], lines 10 to 11; also C in Fig. 1).

(E) The water (C in Fig. 1) is desalinated water using reverse osmosis (paragraph [0021], lines 1 to 5; F in Fig. 1).

Claim 18

Referring to Figures 1 and 2, Claim 18 is for a process for treating sea water to reduce the concentration of dissolved salts in it. Claim 18 is similar to Claim 15, except that flash evaporation is used in the last step instead of reverse osmosis.

(A) To the sea water (A in Fig. 1) is added about 0.4 to about 40 g/L calcium hydroxide, calcium oxide, or a mixture thereof (paragraph [0016], lines 3 to 8; B in Fig. 1). A first precipitate forms (D in Fig. 1) that comprises calcium hydroxide (paragraph [0016], lines 9 to 10).

(B) The first precipitate (D in Fig. 1) is separated from the water ((paragraph [0016], lines 11 to 12; C in Fig. 1).

(C) To the water (also A in Fig. 1) is added about 0.1 to about 60 g/L sodium carbonate and about 0.04 to about 40 g/L sodium hydroxide (paragraph [0017], lines 1 to 2; also B in Fig. 1). A second precipitate forms that comprises magnesium hydroxide (paragraph [0017], lines 8 to 10; also D in Fig. 1).

(D) The second precipitate (also D in Fig. 1) is separated from the water (paragraph [0017], lines 10 to 11; also C in Fig. 1).

(E) The water (also C in Fig. 1) is desalinated using flash evaporation (paragraph [0021], lines 1 to 5; E in Fig. 1).

Claim 21

Claim 21 depends from Claim 15, but also requires a recycling step (as in Claim 6). A mixture is formed (paragraph [0023], lines 1 to 7; top block in Fig. 2) of the second stream (paragraph [0023], lines 7 to 10; E2 in Fig. 1) and the sea water (A in Fig. 1). If the concentration of the compound added in step (A) of Claim 1 is less than about 0.1 wt%, then a sufficient amount of the compound is added to the mixture to bring its concentration within a range of about 0.1 to about 60 wt% (paragraph [0023], lines 12 to 15). The mixture is then recycled to step (B) of Claim 1 (paragraph [0023], 4 to 5; B in Fig. 1).

Claim 22

Claim 22 depends from Claim 18, but also requires a recycling step (as in Claim 6). A mixture is formed (paragraph [0023], lines 1 to 7; top block in Fig. 2) of the second stream (paragraph [0023], lines 7 to 10; E2 in Fig. 1) and the sea water (A in Fig. 1). If the concentration of the compound added in step (A) of Claim 1 is less than about 0.1 wt%, then a sufficient amount of the compound is

added to the mixture to bring its concentration within a range of about 0.1 to about 60 wt% (paragraph [0023], lines 12 to 15). The mixture is then recycled to step (B) of Claim 1 (paragraph [0023], 4 to 5; B in Fig. 1).

(vi) Grounds of rejection to be reviewed on appeal

I. Claims 1 to 11 and 14 to 22 were rejected under 35 U.S.C. 103(a) as being unpatentable over Anderson.

II. Claims 15 to 22 were rejected under 35 U.S.C. 103(a) as being unpatentable over Anderson further in view of Al-Samadi.

III. Claims 1 to 11 were rejected under 35 U.S.C. 103(a) as being unpatentable over Hsing and Anderson.

(vii) Argument

I. Rejection of Claims 1 to 11 and 14 to 22 under 35 U.S.C. 103(a) over Anderson.

Claims 1 to 11 and 14 to 22

The Examiner states, "Anderson discloses a process of treating saline water, including sea water (column 3, lines 12-29), ..." Appellant does not agree and believes that the Examiner may have mis-read the portion of Anderson that she relies upon. The portion of Anderson relied upon by the Examiner (column 3, lines 12 to 29) states:

"Referring now to **FIG. 1**, there is illustrated a flow diagram of a desalinization process utilizing the pre-treatment method of this invention. In this application, the raw saline water enters the process at line **10**. This water can be agricultural drain water, brackish water and the like, which

generally has a dissolved salts content no greater than about 10,000 ppm. Waters which have greater salt contents and, in particular, sea water, which also has a disproportionally high magnesium content, can not be readily treated by this process because of high solubility activities and tendency of magnesium to complex calcium which greatly increase the solubility of calcium. It is also desirable that the sulfate content of the water be less than about 2500 ppm and, most preferably, less than about 1500 ppm to avoid excessive precipitation of calcium sulfate in the treated reject brine of the process.”

In that quote, Anderson clearly states that “sea water ... can not be readily treated by this [his] process.” Thus, Anderson teaches against Appellant’s invention. Appellant’s invention cannot be obvious when the principal reference cited by the Examiner teaches against Appellant’s invention.

All of Appellant’s claims are limited to the treatment of sea water. In paragraph [0012], lines 14 and 15, Appellant states, “Thus, the average ocean salinity is approximately 35 parts per thousand.” Thirty-five parts per thousand is 35,000 parts per million (ppm), which is 3½ times the maximum salinity of 10,000 ppm that Anderson says will work in his invention.

One of the reasons why Anderson’s invention will not work with sea water may be that Anderson adds magnesium hydroxide to precipitate calcium. See column 3, lines 33 to 38. This may be why Anderson states that sea water “which also has a disproportionally high magnesium content, can not be readily treated by this [his] process because of high solubility activities and tendency of magnesium to complex calcium which greatly increase the solubility of calcium.” (Column 3, lines 20 to 24.) Appellant avoids that problem by not adding magnesium, but instead adding “a compound selected from the group consisting of sodium hydroxide, sodium carbonate, potassium hydroxide, potassium

carbonate, calcium hydroxide, calcium carbonate, aluminum hydroxide, aluminum sulfate, aluminum potassium sulfate, and mixtures thereof.” [Note that “calcium oxide should also be in that list as it is named in Claims 9 and 14, which depend from Claim 1, and is described in paragraph [0013], line 3. However, the Examiner would not enter the amendment after final that made this correction.] Appellant’s invention solves the problem that Anderson’s invention has in treating sea water, and solves it in a way that the cited references do not teach.

While the Examiner concedes that Anderson teaches that his invention will not work with sea water (Advisory Action of April 6, 2006: “Patent ‘749 exclude[s] sea water fro[m] a pre-treatment including the addition of magnesium hydroxide in the pre-treatment, to avoid formation of a complex of calcium and magnesium, which increase[s] the solubility for calcium, ...” she continues “... however, the references [sic] also teaches the use of calcium hydroxide alone or in combination with sodium carbonate, to reduce the solubility of calcium carbonate in water as old in the art (see column 2, second paragraph ...)”).

It is believed that the Examiner is referring to these sentences in column 2, lines 14 to 25 of Anderson:

“A number of processes have also been developed for a chemical water softening of waters which contain hardness ions such as calcium and magnesium. Typically, these processes comprise the addition of calcium hydroxide alone or in combination with sodium carbonate to reduce the solubility of the dissolved calcium carbonate in the water. Typical of such treatments is that disclosed in U.S. pat. No. Pat. **3,740,330**. These treatments, however, are not generally applicable to desalinization treatments because they do not sufficiently reduce the concentration of scale-forming dissolved salts in the processed water.”

Please note, first, that these sentences refer to the chemical water

softening of hard water, not sea water. “Hard water” is freshwater that contains high amounts of dissolved calcium and magnesium; it does not contain over 10,000 ppm of sodium chloride, as sea water does.

Second, please note that in the last sentence of the above quote Anderson teaches that those treatments are “not generally applicable to desalinization treatments,” which teaches against using them on sea water.

Third, since the cited sentences refer to U.S. Patent No. 3,740,330 as typical of the water softening process, the Examiner should cite that patent directly instead of relying upon Anderson’s citation of what it teaches. That patent, to Kneale, is for a process of reducing the volume of sludge that is formed in softening water. Kneale treats “surface waters as well as clear well waters.” (Column 4, line 13.) Kneale is treating fresh water, not sea water, and fresh water contains little or no sodium chloride. Kneale uses “lime or lime-soda ash” to precipitate calcium and magnesium. Lime is calcium oxide, CaO , and soda ash is sodium carbonate, Na_2CO_3 . Thus, Kneale requires either calcium oxide alone or calcium oxide with sodium carbonate, and does not use sodium carbonate alone.

Moreover, Anderson adds magnesium hydroxide but in Appellant’s claimed process magnesium hydroxide is not added; it is only precipitated. (“This precipitate is believed to consist of magnesium carbonate, magnesium hydroxide, sodium bicarbonate, and sodium chloride” Paragraph [000026], lines 3 to 5) It is not obvious for Appellant to remove a compound that Anderson teaches to add.

The Examiner states, "It would have been obvious ... to use calcium hydroxide, sodium carbonate, lime and other precipitating agents for precipitating calcium in sea water." Appellant does not agree. Appellant can find nothing in "Anderson's disclosure" that would motivate "one skilled in the art" to use calcium hydroxide in the first precipitation step. Anderson's entire patent is limited to magnesium hydroxide and he never suggests that a compound other than magnesium hydroxide could be used. Moreover, Anderson adds the magnesium hydroxide to precipitate calcium carbonate (column 4, lines 10 to 12). It would not be obvious for Anderson to add one calcium compound to precipitate another calcium compound.

Claim 6

As to Appellant's Claim 6, the Examiner refers to column 8, third paragraph, of Anderson. As explained hereinabove, Claim 6 requires the desalination to produce two streams having different salt concentrations. In Appellant's Figure 1, those two streams are the "GOOD POTABLE WATER E1" and the "CONCENTRATED LEFTOVER SEAWATER E2" (bottom two blocks). The "CONCENTRATED LEFTOVER SEAWATER E2" is mixed with untreated seawater (top block in Figure 1) and becomes the "'E2 + SEAWATER" block at the top of Figure 2, as required in Appellant's Claim 6 ("a mixture is formed of said second stream and said sea water containing dissolved salts.")

In Anderson's Figures 1 and 2, Anderson has a desalination step 34 which forms a water stream 36 and a brine stream 38. Brine stream 38 would be a more concentrated second steam. Anderson does not show the step required in

Appellant's Claim 6. First, of course, Anderson uses "saline water," not sea water, which has a very different composition. Anderson says his process won't work on sea water and never suggests any substitute compounds that would make it work on sea water.

But also, instead of forming a mixture of his saline water in line 10 and his brine in line 38, he instead mixes his brine in line 38 with calcium hydroxide in line 42, which precipitates magnesium hydroxide in settling step 50 (column 7, lines 6 to 8). The precipitated magnesium hydroxide is then recycled to first treatment step 12 (column 7, lines 13 to 18). That is very different from the steps required by Appellant's Claim 6 and it is not obvious to completely alter what Anderson is doing to meet the requirements of Appellant's Claim 6. For these reasons, Claim 6 does not stand or fall with the remaining claims in this rejection.

Claim 14

Appellant's Claim 14 specifies exactly what compounds are to be used in the two precipitation steps and the amounts to be used: "about 0.04 to about 40 g/L of calcium hydroxide, calcium oxide, or a mixture thereof" for the first precipitation and "about 0.1 to about 60 g/L of sodium carbonate and about 0.04 to about 40 g/L of sodium hydroxide, or a mixture thereof" for the second precipitation. Anderson uses magnesium hydroxide for his first precipitation and a flocculant (e.g., polyacrylamide, column 4, lines 41 to 43) for his second precipitation. Appellant fails to understand how it can be obvious to use two completely different compounds, as Claim 14 requires. For these reasons, Claim 14 does not stand or fall with the remaining claims in this rejection.

Claim 15

Since Claim 15 simply restates Claim 14 (but limited to reverse osmosis), the hereinabove-made arguments made as to Claim 14 also apply to Claim 15 and Claim 15 does not stand or fall with the remaining claims in this rejection..

Claim 18

Since Claim 18 simply restates Claim 14 (but limited to flash evaporation), the hereinabove-made arguments made as to Claim 14 also apply to Claim 18 and Claim 18 does not stand or fall with the remaining claims in this rejection.

Claim 21

Since Claim 21 depends from Claim 15, but also requires the recycling step required by Claim 6, the hereinabove-made arguments made as to Claims 15 and 6 also apply to Claim 21 and Claim 21 does not stand or fall with the remaining claims in this rejection.

Claim 22

Since Claim 22 depends from Claim 18, but also requires a recycling step required in Claim 6, the hereinabove-made arguments made as to Claims 18 and 6 also apply to Claim 22 and Claim 22 does not stand or fall with the remaining claims in this rejection.

II. Rejection of Claims 15 to 22 under 35 U.S.C. 103(a) over Anderson in view of Al-Samadi.

Claims 15 to 22

The arguments made hereinabove by the Appellant in response to rejection of Claims 1 to 11 and 14 to 22 over Anderson also apply to this

rejection.

Al-Samadi was cited to show the use of sodium hydroxide to precipitate calcium and magnesium hydroxide. Al-Samadi, however, treats hard water, not sea water. There is no teaching in Al-Samadi that sodium hydroxide is effective in sea water. Moreover, the Examiner relies on column 12, last paragraph, of Al-Samadi, which deals with the removal of "hardness compounds and silica." This is a water-softening process of the type that Anderson says (column 2, lines 22 to 26) "are not generally applicable to desalinization treatments because they do not sufficiently reduce the concentration of scale-forming dissolved salts in the processed water." Thus, it is not obvious to combine Al-Samadi with Anderson when Anderson teaches against using water-softening processes to desalinate.

Claim 18

Since Claim 18 simply restates Claim 15 (but is limited to flash evaporation), the hereinabove-made arguments made as to Claim 15 also apply to Claim 18 and Claim 18 does not stand or fall with the remaining claims in this rejection.

Claim 21

Since Claim 21 depends from Claim 15, but also requires the recycling step required by Claim 6, the hereinabove-made arguments made as to Claims 15 and 6 also apply to Claim 21 and Claim 21 does not stand or fall with the remaining claims in this rejection.

Claim 22

Since Claim 22 depends from Claim 18, but also requires a recycling step

required in Claim 6, the hereinabove-made arguments made as to Claims 18 and 6 also apply to Claim 22 and Claim 22 does not stand or fall with the remaining claims in this rejection.

III. Rejection of Claims 1 to 11 under 35 U.S.C. 103(a) over Hsing and Anderson.

Claims 1 to 11

The arguments made hereinabove by the Appellant in response to rejection of Claims 1 to 11 and 14 to 22 over Anderson also apply to this rejection.

Hsiung was cited to show treatment of sea water with the claimed precipitating agents, the Examiner citing column 7, lines 38 to 43. Appellant believes that the Examiner intended to cite column 17, lines 38 to 43. As best Appellant can determine, the term "sea water" appears only 3 times in Hsiung, on Figure 11, on Figure 12, and in column 17, line 40. All three appearance of "sea water" have to do with the experiments described by Figures 11 and 12.

Figure 11 describes start up tests in which valve 155 was opened quickly or slowly and gives the effect that slow or fast opening of that valve had on the pressure. Figure 11 shows that opening the valve over a period of 45 seconds gave the best results, a lower driving pressure, ΔP .

Figure 12 describes the effect of leaving valve 155 opened or closed during acid cleaning of the filter. Figure 12 shows that it is better to close valve 155 because the driving pressure, ΔP , is lower.

In both of those experiments Hsiung used seawater + 50 ppm aluminum sulfate. Neither experiment involved any precipitation of any compound in the sea water, as best Appellant can determine. Both tests were performed only to determine the effect that valve 155 had on pressure. Moreover, the aluminum sulfate, known as “alum,” is described by Hsiung in column 9, line 13, as a “pretreatment additive” (column 9, line 11), the purpose of which is to “render the dynamic membrane on the filter tube wall cohesionless.” (Column 9, lines 4 and 5). The alum does not precipitate anything; Hsiung uses lime and a polymer for that purpose (column 5, lines 60 to 67).

Furthermore, the amount of aluminum sulfate used by Hsiung is too low to effectively precipitate compounds in sea water. Hsiung uses only 50 ppm of aluminum sulfate. Appellant’s Claim 1 requires the use of at least 0.1 g/L of aluminum sulfate, which is 100 ppm, twice the amount used by Hsiung.

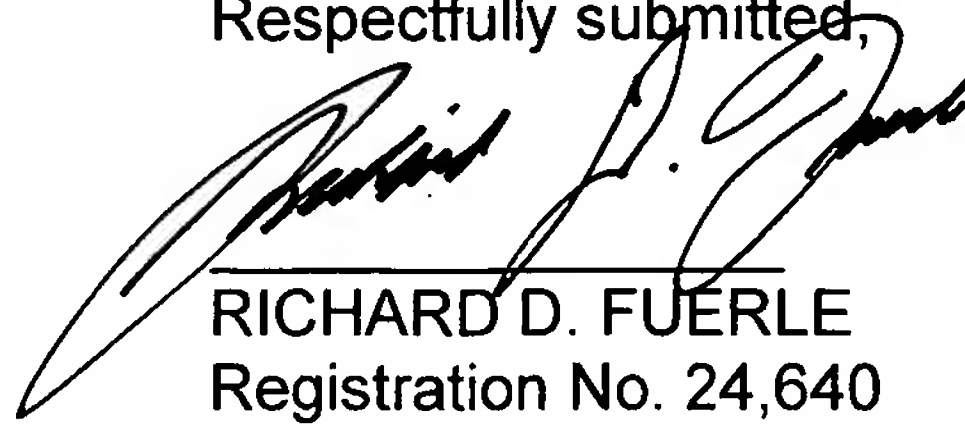
Appellant does not know why Hsiung used sea water in those two experiments, but since nothing was precipitated, it may have been just because sea water was available and free. There is no teaching in Hsiung that his invention will work on sea water and the object of his invention is to soften hard water. (See column 5, line 60, for example.)

Claim 6

The arguments made hereinabove concerning the rejection of Claim 6 over Anderson also apply to this rejection and for these reasons, Claim 6 does not stand or fall with the remaining claims in this rejection.

For the reasons given in this Brief, it is submitted that Appellants' invention is not obvious over the references cited. The Board is therefore requested to reverse the Examiner and find Claims 1 to 11 and 14 to 22 to be allowable.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Richard D. Fuerle", is written over a horizontal line.

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(vii) Claims Appendix

1. A process for treating sea water comprising

(A) adding to said sea water about 0.1 to about 60 g/L of a compound selected from the group consisting of sodium hydroxide, sodium carbonate, potassium hydroxide, potassium carbonate, calcium hydroxide, calcium carbonate, aluminum hydroxide, aluminum sulfate, aluminum potassium sulfate, and mixtures thereof, whereby a precipitate of a calcium compound forms in said water;

(B) separating said precipitate from said water; and

(C) desalinating said water.

2. A process according to Claim 1 wherein prior to step (A) said sea water is filtered.

3. A process according to Claim 1 wherein said sea water is desalinated using reverse osmosis.

4. A process according to Claim 1 wherein said sea water is desalinated using flash evaporation.

5. A process according to Claim 1 wherein said solid precipitate is separated by filtration.

6. A process according to Claim 1 wherein desalinating said sea water produces a first stream that has a lower concentration of dissolved solids and a second stream that has a higher concentration of dissolved solids, and

(1) a mixture is formed of said second stream and said sea water;

(2) if the concentration of said compound in said mixture is less than about 0.1 wt%, a sufficient amount of said compound is added to said mixture to bring its concentration within a range of about 0.1 to about 60 wt%; and

(3) said mixture is recycled to step (B).

7. A process according to Claim 1 wherein acid is added to said sea water after step (B) to lower the pH of said sea water to between about 6.5 and about 8.5.

8. A process according to Claim 7 wherein the pH of said sea water is adjusted before step (C).

9. A process according to Claim 1 wherein said compound is selected from the group consisting of calcium oxide, calcium hydroxide, sodium hydroxide, sodium carbonate, and mixtures thereof.

10. A process according to Claim 1 wherein the amount of said compound is about 0.2 to about 40 g/L.

11. A process according to Claim 1 wherein said desalinating is performed at a temperature in excess of 70°C.

12. (Cancelled)

13. (Cancelled)

14. A process according to Claim 1 wherein said compounds are added in two steps, a first step in which about 0.04 to about 40 g/L of calcium hydroxide, calcium oxide, or a mixture thereof is added, whereby a first precipitate is formed and is separated from the water, and a second step in which about 0.1 to about 60 g/L of sodium carbonate and about 0.04 to about 40 g/L of sodium hydroxide, or a mixture thereof is added, whereby a second precipitate is formed and is separated from the water.

15. A process for treating sea water to reduce the concentration of dissolved salts therein comprising

(A) adding to said sea water about 0.04 to about 40 g/L of a compound selected from the group consisting of calcium hydroxide, calcium oxide, and mixtures thereof, whereby a first precipitate that comprises calcium hydroxide is formed;

(B) separating said first precipitate from said water;

(C) adding to said water about 0.01 to about 60 g/L sodium carbonate and

about 0.04 to about 40 g/L sodium hydroxide, whereby a second precipitate that comprises magnesium hydroxide is formed;

(D) separating said second precipitate from said water; and

(E) desalinating said water using reverse osmosis.

16. A process according to Claim 15 wherein, in step (A), said compound is calcium oxide.

17. A process according to Claim 16 wherein the amount of said calcium oxide added is about 0.07 to about 30 g/L, the amount of said sodium carbonate added is about 0.12 to about 50 g/L, and the amount of said sodium hydroxide added is about 0.9 to about 34 g/L.

18. A process for treating sea water to reduce the concentration of dissolved salts therein comprising

(A) adding to said sea water about 0.4 to about 40 g/L of a compound selected from the group consisting of calcium hydroxide, calcium oxide, and mixtures thereof, whereby a first precipitate that comprises calcium hydroxide is formed;

(B) separating said first precipitate from said water;

(C) adding to said water about 0.1 to about 60 g/L sodium carbonate and about 0.04 to about 40 g/L sodium hydroxide, whereby a second precipitate that comprises magnesium hydroxide is formed;

(D) separating said second precipitate from said water; and

(E) desalinating said water using flash evaporation.

19. A process according to Claim 18 wherein, in step (A), said compound is calcium oxide.

20. A process according to Claim 19 wherein the amount of said calcium oxide added is about 0.07 to about 30 g/L, the amount of said sodium carbonate added is about 0.12 to about 50 g/L, and the amount of said sodium hydroxide added is about 0.9 to about 34 g/L.

21. A process according to Claim 15 wherein desalinating said sea water produces a first stream that has a lower concentration of dissolved solids and a second stream that has a higher concentration of dissolved solids, and

(1) a mixture is formed of said second stream and said sea water;

(2) if the concentration of said compound in said mixture is less than about 0.4 g/L, a sufficient amount of said compound is added to said mixture to bring its concentration within a range of about 0.4 to about 40 g/L; and

(3) said mixture is recycled to step (C).

22. A process according to Claim 18 wherein desalinating said sea water produces a first stream that has a lower concentration of dissolved solids and a

second stream that has a higher concentration of dissolved solids, and

(1) a mixture is formed of said second stream and said sea water;

(2) if the concentration of said compound in said mixture is less than about 0.4 g/L, a sufficient amount of said compound is added to said mixture to bring its concentration within a range of about 0.4 to about 40 g/L; and

(3) said mixture is recycled to step (C).

(ix) Evidence appendix

None.

(x) Related proceedings appendix

None.